Lancaster Laboratories

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

May 05, 2011

Project: SUN: Philadelphia Refinery AOI-10

Submittal Date: 04/25/2011
Group Number: 1243735
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
BH-10-59_0-2' Grab Soil	6267997

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

Lancaster Laboratories

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Analysis Report

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Chad A. Moline
Group Leader

Lancaster Laboratories

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Analysis Report

Sample Description: BH-10-59_0-2' Grab Soil
Philadelphia Refinery AOI-10
COC: 259433 BH-10-59_0-2'

LLI Sample # SW 6267997
LLI Group # 1243735
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-10

Collected: 04/22/2011 10:30 by SS

Submitted: 04/25/2011 15:50
Reported: 05/05/2011 18:45

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

10-59

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**	**ug/kg**	**ug/kg**	
10950	Benzene	71-43-2	12	6	0.6	0.98
10950	1,2-Dibromoethane	106-93-4	< 6	6	1	0.98
10950	1,2-Dichloroethane	107-06-2	< 6	6	1	0.98
10950	Ethylbenzene	100-41-4	< 6	6	1	0.98
10950	Isopropylbenzene	98-82-8	< 6	6	1	0.98
10950	Methyl Tertiary Butyl Ether	1634-04-4	< 6	6	0.6	0.98
10950	Toluene	108-88-3	6	6	1	0.98
10950	1,2,4-Trimethylbenzene	95-63-6	< 6	6	1	0.98
10950	1,3,5-Trimethylbenzene	108-67-8	< 6	6	1	0.98
10950	Xylene (Total)	1330-20-7	< 6	6	1	0.98

The GC/MS volatile internal standard peak areas were outside the QC limits. A re-analysis was performed, and the matrix effect was confirmed.

GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**	**ug/kg**	**ug/kg**	
10724	Anthracene	120-12-7	< 2,000	2,000	410	10
10724	Benzo(a)anthracene	56-55-3	2,100	2,000	410	10
10724	Benzo(a)pyrene	50-32-8	< 2,000	2,000	410	10
10724	Benzo(b)fluoranthene	205-99-2	2,100	2,000	410	10
10724	Benzo(g,h,i)perylene	191-24-2	< 2,000	2,000	410	10
10724	Chrysene	218-01-9	2,300	2,000	410	10
10724	Fluorene	86-73-7	< 2,000	2,000	410	10
10724	Naphthalene	91-20-3	< 2,000	2,000	410	10
10724	Phenanthrene	85-01-8	4,100	2,000	410	10
10724	Pyrene	129-00-0	3,900	2,000	410	10

Reporting limits were raised due to interference from the sample matrix.

The GC/MS semivolatile internal standard peak areas were outside of the QC limits for both the initial injection and the re-injection. The values here are from the initial injection of the sample.

Metals	**SW-846 6020**		**mg/kg**	**mg/kg**	**mg/kg**	
06135	Lead	7439-92-1	401	1.17	0.0606	10
Wet Chemistry	**SM20 2540 G**		**%**	**%**	**%**	
00111	Moisture	n.a.	18.3	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

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Analysis Report

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Philadelphia Refinery AOI-10
COC: 259433 BH-10-59_0-2'

LLI Sample # SW 6267997
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SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

10-59

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10950	BTEX/MTBE/EDB/EDC/Cumene/TMBs	SW-846 8260B	1	X111191AA	04/29/2011 10:42	Emily R Styer	0.98
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035	1	201111624232	04/22/2011 10:30	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201111624232	04/22/2011 10:30	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201111624232	04/22/2011 10:30	Client Supplied	1
10724	PAH 8270 (microwave)	SW-846 8270C	1	11118SLE026	05/04/2011 10:32	Brian K Graham	10
10814	BNA Soil Microwave PAH	SW-846 3546	1	11118SLE026	04/29/2011 03:35	Roman Kuropatkin	1
06135	Lead	SW-846 6020	1	111171026001A	04/29/2011 15:31	Choon Y Tian	10
11026	SW SW846 ICP-MS Digest	SW-846 3050B	1	111171026001	04/27/2011 12:18	James L Mertz	1
00111	Moisture	SM20 2540 G	1	11118820008A	04/28/2011 19:48	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1243735
Reported: 05/05/11 at 06:45 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: X111191AA	Sample number(s): 6267997								
Benzene	< 5	5.	0.5	ug/kg	95		80-120		
1,2-Dibromoethane	< 5	5.	1	ug/kg	101		80-120		
1,2-Dichloroethane	< 5	5.	1	ug/kg	95		71-129		
Ethylbenzene	< 5	5.	1	ug/kg	98		80-120		
Isopropylbenzene	< 5	5.	1	ug/kg	101		76-120		
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	89		74-121		
Toluene	< 5	5.	1	ug/kg	97		80-120		
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	96		79-120		
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	97		78-120		
Xylene (Total)	< 5	5.	1	ug/kg	101		80-120		
Batch number: 11118SLE026	Sample number(s): 6267997								
Anthracene	< 170	170.	33	ug/kg	97		83-111		
Benzo(a)anthracene	< 170	170.	33	ug/kg	98		82-111		
Benzo(a)pyrene	< 170	170.	33	ug/kg	103		63-138		
Benzo(b)fluoranthene	< 170	170.	33	ug/kg	110		61-133		
Benzo(g,h,i)perylene	< 170	170.	33	ug/kg	106		63-130		
Chrysene	< 170	170.	33	ug/kg	97		81-111		
Fluorene	< 170	170.	33	ug/kg	101		81-117		
Naphthalene	< 170	170.	33	ug/kg	94		83-112		
Phenanthrene	< 170	170.	33	ug/kg	95		83-109		
Pyrene	< 170	170.	33	ug/kg	97		80-121		
Batch number: 111171026001A	Sample number(s): 6267997								
Lead	< 0.198	0.198	0.0103	mg/kg	92		83-110		
Batch number: 11118820008A	Sample number(s): 6267997								
Moisture					100		99-101		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: X111191AA	Sample number(s): 6267997 UNSPK: P266108								
Benzene	62	107	55-143	14	30				
1,2-Dibromoethane	78	103	54-129	6	30				
1,2-Dichloroethane	55685 (2)	-747 (2)	68-131	197*	30				
Ethylbenzene	92	101	44-141	26	30				

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1243735
Reported: 05/05/11 at 06:45 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Isopropylbenzene	163*	64	38-144	89*	30				
Methyl Tertiary Butyl Ether	77	85	55-129	24	30				
Toluene	160*	115	50-146	63*	30				
1,2,4-Trimethylbenzene	88	89	37-149	29	30				
1,3,5-Trimethylbenzene	63	97	38-150	9	30				
Xylene (Total)	87	103	44-136	18	30				
Batch number: 11118SLE026	Sample number(s): 6267997 UNSPK: P267988								
Anthracene	108	694*	40-147	133*	30				
Benzo(a)anthracene	131	1575*	32-150	149*	30				
Benzo(a)pyrene	140*	1628*	57-129	148*	30				
Benzo(b)fluoranthene	159*	2292*	53-131	155*	30				
Benzo(g,h,i)perylene	118	839*	60-123	129*	30				
Chrysene	122*	1441*	76-114	146*	30				
Fluorene	98	310*	46-137	99*	30				
Naphthalene	139*	428*	52-132	89*	30				
Phenanthrene	161*	2138*	34-147	154*	30				
Pyrene	154*	2829*	76-124	157*	30				
Batch number: 111171026001A	Sample number(s): 6267997 UNSPK: P267982 BKG: P267982								
Lead	-1433 (2)	-224 (2)	75-125	7	20	524	487	7	20
Batch number: 11118820008A	Sample number(s): 6267997 BKG: P267991								
Moisture						17.3	17.0	2	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TCL(4.3)by 8260(soil)
Batch number: X111191AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6267997	110	112*	119	66*
Blank	102	104	91	92
LCS	101	106	101	98
MS	94	70	107	90
MSD	97	98	103	93
Limits:	71-114	70-109	70-123	70-111

Analysis Name: PAH 8270 (microwave)
Batch number: 11118SLE026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6267997	58	66	60
Blank	90	93	94
LCS	91	101	93

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1243735
Reported: 05/05/11 at 06:45 PM

Surrogate Quality Control

MS	100	111	94
MSD	100	102	87
Limits:	55-121	56-121	43-124

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1243735 Sample # 6267997

COC # 259433

Please print. Instructions on reverse side correspond with circled numbers.

(1)
Client: SUN - AQUATERRA Acct. #:
Project Name/#: PHILA REF AOI-10 PWSID #:
Project Manager: T. DOERR P.O.#:
Sampler: S. SYKES Quote #:
Name of state where samples were collected: PA

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4) Soil	Water	Other	Total # of Containers	(5) Analyses Requested / Preservation Codes	Remarks
BH-10-59_0-2'	4/22/11	1030	X		X			4	X	☆ See attached list for analyses
										temp 1.8-2.4°C

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

SDG Complete? Yes No

Relinquished by:	Date	Time	Received by:	Date	Time
			D Ryady	3/25/11	TRS
D Ryady	3/24/11	945			
Sample Fridge	4/22/11	1330	Sample Fridge	4/22/11	1330
IAQT	4/25/11	1070	D Ryady	4/25/11	1070
D Ryady	4/25/11	1550		4/25/11	1550

(9)

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

acct 10132 grp 1243735

#6267997

★ So. 1

Table 1b
Constituents of Concern for Soil
AOI 10 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

METALS	CAS No.
Lead (total)	7439-92-1

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene dibromide	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo (g,h,i) perylene	191-24-2
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Notes:

1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, *Closure Requirements for Underground Storage Tank Systems,* effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List.
2. *Select soil samples* to be collected within the CAMU and delineation soil samples will be analyzed for full TCL VOCs, TCL SVOCs, and TAL metals.

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.